Newton's Second Law

Name: ________________ Section: 2AL-___ Date performed: __/__/__

Lab station: ____ Partners: ________________________

Preliminary data

(Q-1) Determine the position of the glider cart initially (x_0), when it triggers the first photogate (x_1), and when it triggers the second photogate (x_2).

$x_0 =$ ________ m $x_1 =$ ________ m $x_2 =$ ________ m

(Q-2) Determine the lead distance (l) and the distance between photogates (d), and calculate the numerator for the acceleration.

$l =$ ________ m $d =$ ________ m $2(\sqrt{l+d} - \sqrt{l})^2 =$ ________ m

Measuring glider mass using Newton's Second Law

(Q-3) Fill in the following table.

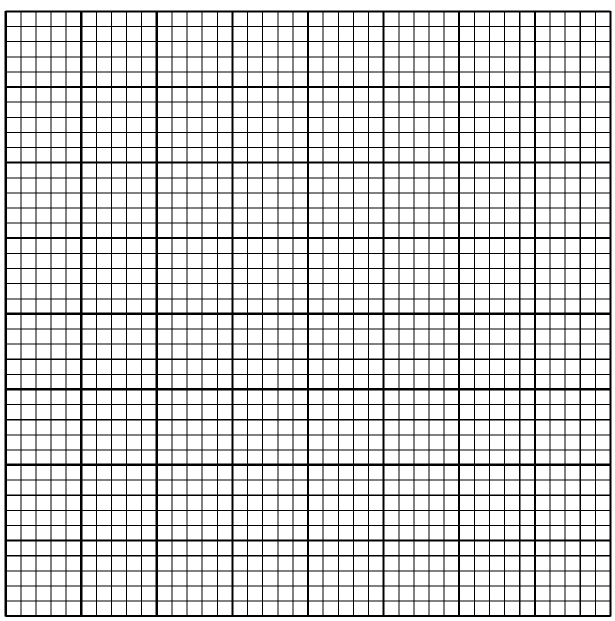
Hanging mass (kg)	Measured photogate times (s) 1	2	3	4	5	Average Δt (s)	Acceleration (m/s^2)
0.050							
0.060							
0.070							
0.080							
0.090							
0.100							

How did you calculate the acceleration?

(Q-4) Continue the analysis by completing the following table.

Hanging mass (kg)	Hanging weight (N)	Acceleration (m/s^2)	Tension (N)
0.050			
0.060			
0.070			
0.080			
0.090			
0.100			

(Q-5) Plot T vs. a and determine the experimental value of the glider mass.



Experimental mass = ________ ± ________ Friction force = ________

Explain how these these two quantities are obtained from your graph.

Compare experimental mass with measured mass

(Q-6) Measure the glider mass with an electronic balance.

Measured mass = __________ ± __________

(Q-7) Compare the two masses using the discrepancy test.

Do they agree? Explain.

Exercises

Suppose you were to increase l without changing d. How would you expect the photogate time to be affected?

(A) The photogate time should decrease.
(B) The photogate time should increase.
(C) The photogate time should remain the same.
(D) The answer depends on the specific values of l and d.

Explain:

Suppose that in the process of releasing the glider, you managed to give the glider a small push (therefore releasing it with non-zero initial velocity). How would you expect the photogate time to be affected?

(A) The photogate time should decrease, regardless of whether the initial velocity is in the forward or backward direction.
(B) The photogate time should increase, regardless of whether the initial velocity is in the forward or backward direction.
(C) The photogate time should remain the same.
(D) The answer depends on whether the glider is pushed in the forward or backward direction.

Explain:

If the lead distance l were exactly zero, then the numerator of the acceleration, $2(\sqrt{l+d} - \sqrt{l})^2$, would reduce to $2d$, and the acceleration itself would be given by $a = 2d/\Delta t^2$. Suppose instead that the lead distance were 1% of d (i.e., $l = 0.01d$). In this case, $2(\sqrt{l+d} - \sqrt{l})^2$ would equal

(A) $1.99d$
(B) $1.98d$
(C) $1.96d$
(D) $1.80d$
(E) $1.64d$

Using you answer above, explain why we do not try to release the glider cart from the first photogate position.

The acceleration of the glider between the time it is released and the time it reaches the second photogate is

(A) Zero.
(B) Increasing.
(C) Decreasing.
(D) Constant.

After the glider has been released, the tension in the string is _____ the hanging weight.

(A) equal to
(B) less than
(C) greater than
(D) Not enough information given

Explain without equations:

Before the glider has been released (while it is being held fixed in place), the tension in the string is _____ the hanging weight.

(A) equal to
(B) less than
(C) greater than
(D) Not enough information given

Explain without equations: